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William V. Mayer

*National Association of Biology Teachers*

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# Objectives of Animal Use in Biology Courses

William V. Mayer

## *Abstract*

*To confine discussion of educational use of animals to experimentation is to focus on only part of the animal use problem. To focus on use of animals in the classroom solely is to negate the value of field and community resource areas such as zoos, animal parks, nature trails, etc. The primary objective in dealing with living organisms is to inculcate a respect for all life. Objectives that focus on use of living animals for experimental purposes can, at best, be secondary and may in many cases be contrived. An understanding of animal life requirements and animal contributions is an objective worthy of pursuit. Living animals in the classroom give viability to biological studies and provide opportunities for animal-human interaction that can be channeled into a series of positive behaviors. Animals have been misused in classrooms by being considered solely as experimental objects through which to ascertain the fundamentals of anatomy and physiology. Much broader objectives must be sought if animal use is to make a meaningful contribution to the educated citizenry of the future.*

## *Introduction*

Biology is the study of life and, as such, should deal with the living. Classical biology was chiefly an investigation into systematics and morphology, based primarily on preserved, stuffed, skeletonized, or otherwise prepared specimens. Laboratory investigations focused not on biology, but rather necrology (Mayer, 1973). In many biology classes the student never saw a living organism. The emphasis was not on experimentation; it was confined to observations of a confirmational nature. The laboratory, as it was called, was primarily a site for dissection. This was conducted on the basis of look-dissect-draw-label-memorize. There was little for a student to gain from such exercises that was not already obtainable in the labelled diagrams included in most textbooks. Limited experimentation, here again basically of a confirmational nature, was conducted through the discipline of physiology. Nerve-muscle preparations and observations of heartbeat, peristalsis, and occasionally metabolic rate were about the only ways live animals were used in physiology courses.

As we approach the end of the twentieth century, declining enrollments, static budgets, high costs, additional workload, limited facilities, and the expenditure of time militate against laboratory work in biology. One finds not more but less emphasis on

the laboratory today than in the early sixties. Of the laboratory work offered, only a fractional amount is devoted to animals, and of this, an even tinier fraction involves live animals. The frog, by choice or custom, is still the most commonly used laboratory vertebrate. The care and attention that must be devoted to live vertebrates in the classroom has worked strongly against their use. Thus, animal use in biology classrooms is, at best, limited; and the publicity concerning inhumane treatment of animals in biology classes is primarily concerned with that aberrant incident such as in a science fair where teacher and student are involved in an experiment usually beyond the capacities of both.

There is no call, from an educational standpoint, to subject animals to any form of cruelty. The frustrated medical school aspirations of some teachers and frequent parental hopes that Little Johnny may become an MD do not provide a rational basis for surgical intervention sloppily performed and imperfectly understood. It is not the province of the secondary school to teach either cruelty or callousness, and to subject animals to either for the pursuit of trivial and in some cases deceptive objectives cannot be condoned.

If animals, and particularly vertebrate animals, are so little used in the formal course work of biology, one would doubt the necessity for a conference on the use of animals in high school biology classes. However, it is the presence of living organisms that distinguishes biology classrooms from the others in an average school. Therefore I, for one, speak for increased use of animals in high school biology classes and science projects. Not in the pseudo-surgical style of pretended experimentation, but with an entirely different set of objectives. In looking back through high school laboratory manuals, it is hard to see as valid an objective such as, "To dissect a frog and study its internal structure." Remembering that for at least 50 percent of our population, biology may be the first, last, and only science to which they are exposed, it is difficult to ascertain the value of knowing the internal structure of a frog and how to dissect one as a long-term educational goal for the average citizen. That is about as meaningful as having the students learn the parts of a crayfish appendage, which can also be considered inert knowledge, for those names have no meaning in the life of most citizens.

The question constantly has to be asked, *why?* Why are we doing certain things in the classroom? And if the answer to why is trivial or limited to but a tiny fraction of our population, it seems an unnecessary task to pursue at this level. The answers to *why* questions constitute a set of objectives for animal use in biology courses.

### *The Purposes of Education*

Educational objectives are somewhat like the weather; everyone talks about them, but little is done about them. When one questions objectives, one normally gets high-sounding platitudes in response. The purposes of education are to teach students to think, to become productive citizens, to be able to learn on their own, and to become reasoning and reasonable beings. To be against these proud objectives is akin to being against both mother and apple pie. But just because these are so broad and difficult to measure, objectives almost trivial in nature are frequently substituted. Classrooms then concentrate on detail rather than concept, and on measurable outcomes in lieu of pervasive objectives more difficult to quantify.

Education is a multibillion dollar, ad hoc enterprise which, because it has ill-defined objectives, is pulled and hauled from one side to another by pressure groups and educational faddists. Many of the pressures are not in themselves bad. The

concept of back to basics would be acceptable if we could only agree on just what it is basics were, and whose basics we should go back to. Educationists are constantly under pressure to add something to the curriculum, remove something from the curriculum, or change something within the curriculum. And, in attempting to placate those diverse and often contradictory points of view, education seems to proceed in a pattern consisting of two steps forward, one step back, followed by a series of lateral arabesques.

As noted, in order to establish a meaningful educational pattern, the question *why?* must be constantly asked. Why are we doing certain things? Why is a certain topic in a curriculum? Why are we having students do this, that, or the other? And answers such as "We've always done it," "It's good for the student," "It prepares them for college," "It trains the mind" are inadequate substantiation. We might start with asking why biology is taught at all in high school. If its purpose is to acquaint the student with the living world and his interrelationships with it in time and space, then all other objectives become subsidiary to that one. We realize that our primary objective is not the training of biologists, for it is not the role of the secondary school to initiate career goals that would of necessity be based on inadequate exposure to a given field. Fifty percent of today's citizens do not go on to college, and secondary school for half our population must be regarded as a terminal educational experience, not a college preparatory one. Of thirty students in a required ninth-grade science course, only one can be expected to study science as far as the bachelor's degree level. Of a thousand students entering the fifth grade, only 732 will graduate from high school, only 285 will enter college, only 220 will graduate, and only 40 of those will obtain science degrees (Tarp, 1978). In our secondary schools, therefore, we are training citizens for scientific or, in this case, biological literacy. The content of the curriculum must be judged within that objective.

### *Changing Roles of Animals in Education*

The past two decades have seen marked changes in the content and conceptual load of secondary school biology courses. I am proud of what the Biological Sciences Curriculum Study has done to bring about these changes, for I believe them to be changes for the better. Prior to 1960 the emphasis in high school biology was primarily on morphology and systematics. Organism structure and organism identification were the two major emphases in terms of course content. The past twenty years have seen a diminution in this emphasis to accommodate the inclusion of such topics as molecular biology, genetics, ecology, behavior, and similar topics. With this change in content and concept, together with the changing role of the school, there has actually been a diminution rather than an increase in animal use.

The biological supply houses that used to provide barrels of pickled frogs, crayfish, grasshoppers, earthworms, and other organisms for dissection find this portion of their business greatly reduced. Economics, if nothing else, has dictated less use of expensive, expendable laboratory supplies such as preserved or living specimens. The changing school day, the unionization of teachers, and the general turning away from science have also brought less dependence on laboratory-centered activity and more on textbook exercises. Many of the affective objectives of education can be inculcated without extensive laboratory experiences, as evidenced by "Invitations to Inquiry," developed by Joseph J. Schwab (Mayer, 1978). In the face of such changes, what is the role of animals in a biology classroom?

### *The Value of Animals in Education*

Why are animals to be used in biology courses? One answer is to give the students an acquaintance with examples of the vast panoply of organisms that exist. Representatives of various animal phyla provide dramatic evidence of diversity, adaptation, and behavior. To see the underside of a starfish as it crawls along the glass of an aquarium will leave a much more vivid picture of the structure and function of a water vascular system and tube feet in locomotion than any number of pictures or lines of text could possibly communicate. To feel that a snake is not cold and slimy but at room temperature and surprisingly dry is to communicate an important bit of information about this legless reptile. To touch a toad and not get warts is to give lie to the old wives' tale. The examples are infinite. Aquatic and terrestrial, vertebrate and invertebrate, male and female—all attest to the infinite variety within the animal kingdom, and each example teaches both conscious and subconscious lessons in a fashion far more vivid and far longer retained than simply telling or reading or looking at pictures. Demonstration, then, is an effective form of education, and to observe and perhaps touch a variety of living organisms constitutes a powerful lesson in what an animal is and what a great diversity of animals there are.

A second answer to the question *why?* is to provide an understanding of animal behavior, which can only be communicated by living organisms and observation of their living. Watching a rabbit or a guinea pig eat a meal or clean its young provides data not easily communicated either by photograph or text. Listening to a bird sing, a frog croak, or a snake hiss provides dramatic evidence of another type of communication. To watch interactions between organisms—the behavior of a single mouse is not the same as it is when that mouse is with others—is to begin to understand social structures. Social interaction teaches powerful lessons.

A third answer to why I would keep animals in the laboratory is to develop an understanding of animal care and a sense of responsibility for caring. The nutritional requirements of animals—the food, the water, the necessity for cage cleaning (a concept of sanitation), the development of an animal environment, suitable protection against temperature changes (wind, sun, noise), nesting materials or bedding, balancing an aquarium, the interaction of plants and animals—all can be taught by the care and maintenance of animals. An aquarium, a terrarium, or animals individually or collectively housed teach a variety of lessons that require both thought and responsibility. To have responsible students take animals home for weekends or holidays enlarges upon this objective. Living organisms meet certain childhood needs not likely to be as effectively met by other alternatives (Wastnedge, 1972).

Caring for animals, observing them, understanding their requirements for life, comprehending their diversity, and learning new things about them are worthwhile objectives. But transcending all of these is a more important and derivative objective—respect for living things. Respect is not taught directly: it is learned by example and application. I cannot think of a more powerful objective for animal use, and one unlikely to be achieved in any way but by contact with living organisms within a framework of guidance and example.

These objectives, which are primarily within the affective domain, are difficult to clarify and to measure. But to make no attempt to achieve them is a capitulation to the more prosaic and mundane type of objective as when the student places acetic acid on the back of a frog to observe a reflex action far better demonstrated through the patellar reflex of a fellow student.

I inveigh against the use of animals in contrived and essentially specious circumstances. The bulk of so-called animal experimentation at the secondary school level constitutes not only not an experiment but frequently a device to teach lessons we really do not want students to learn. Sacrificing animals for trivial causes cannot be justified. So many times teachers have said that students must use animals in order to absorb the scientific method or to understand experimentation. But the scientific method and controlled experiments can be performed without the use of any animal or indeed, of any living organism. As a matter of fact, living organisms are largely unsatisfactory experimental subjects because of their high degree of variability and the extreme difficulty of controlling those variables in order to have a truly controlled experimental situation. Teachers frequently complain that students have little success with animal experimentation because the answers "don't come out right." Animals constitute fairly complex experimental organisms and require a degree of sophistication for their proper use not possessed by secondary school students nor, occasionally, by their teachers.

### *Animals in Science Projects*

As noted in the title of this conference, we are to deal not only with high school biology classes, but also with science projects. It is in this latter category that most of what has been categorized as animal mistreatment occurs. Too often, students have inadequate supervision for science projects. They are designed, in large measure, to be done on the student's own, as independent pieces of work. Frequently, they are accomplished outside the school. But the greatest source of difficulty is attempting to run before one can crawl. Students are naturally attracted to frontier kinds of research, usually the more bizarre the better, and they attempt sophisticated experimentation with crude apparatus, little comprehension of what is to be done or how to do it, in a largely unsupervised milieu. This experimental use of animals has often been occasioned by the frustrated medical ambitions of certain biology teachers rather than by the applicability of the experimentation to the curriculum as a whole and the student enterprise in particular. There are teachers who feel that animal experimentation is a worthy secondary school activity because of what one might call the Dr. Kildare Syndrome. Unfortunately, most of this animal experimentation is not only beyond the skill of the student but frequently beyond the skill of the teacher. It ends up teaching no lesson except that animals suffer and die in inexperienced hands.

I have judged science fairs at local, state, and national levels, and in talking to the students have found many but poorly understood what they had attempted to do when using animals. Some did not demonstrate responsibility for the living organisms in their charge. Such activities not only do not constitute an educational experience, but demonstrate an absence of educational growth and a callous disregard for living organisms. It redounds poorly on both the teacher and the student to attempt work for which neither has sufficient background. Rules by which people would be quite willing to abide in the physical sciences seem to be ignored in the biological sciences. One does not usually begin constructing one's first refracting telescope by grinding a twelve-inch mirror; one starts out on smaller blanks to master the technique. In electronics, students are perfectly willing to master basic circuitry before working with microcircuits, but I have yet to see a student who understood enough about the normal behavior of an organism to be able to contrast it with whatever the experimental behavior turned out to be.

There are many worthwhile lessons to be learned from living organisms that could constitute decent science fair projects that involve no harm to the organisms involved. Studies on locomotion, behavior, interaction, care of the young, food preferences, and so on can all be conducted without any trauma to the organisms concerned and certainly would teach more than an ill-conceived application of little-understood technology to less understood animal systems.

### *Human-Animal Interactions*

It is not going to be possible to isolate students from animals. At home they may have dogs or cats, or be given a baby chick or duck at Easter, or have an aquarium, or pull wings off of flies. By having as a major objective of animal use respect for living things, the latter will be unlikely to happen. Not only are students exposed to animals in the neighborhoods where they live, but zoological parks, wild animal parks, aquariums, and seaquariums are all sources of information about living organisms that transcend the classroom and can be profitable experiences to students trained in observation and understanding of living animals. Visits to national parks also provide opportunities to observe and understand.

The problem is not simply confined to animals in classrooms, but animals in relation to human beings everywhere. Field and community resource areas are rich in examples of human-animal interaction. We've all seen people feeding animals that should not be fed, attempting to pick up animals that bite, poking at, yelling at, running after, and in general endangering themselves, the animals, and those people who will come later to observe frightened and antagonistic organisms. Objectives of animal use should transcend the boundaries of the school. But only by beginning in the classroom can we teach those lessons that have applicability beyond the boundaries of the school.

### *Conclusion*

I do not believe in random animal experimentation in secondary schools. I do believe in using animals to inculcate the kind of affective objectives that will stand the students in good stead, not only in the classroom, but what is more important, outside the classroom as well. Only then will they come to develop that respect for all living things we must have if our current environment is to remain unscathed for future generations to possess and enjoy.

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## Student (and Animal) Welfare

Leonard M. Krause

### *Abstract*

Adolescents exhibit affection for numerous vertebrates and appear to sympathize and to identify with traumas these animals experience. Therapeutic benefits students attach to nurturing and breeding certain vertebrates are evident; destruction of these same creatures produces clearly negative attitudes by students toward the science course and the instructor. "Case histories" documented while teaching high school students working with vertebrates are reviewed and are related to specific techniques (e.g., pithing) utilized by numerous instructors. Motivation, increased attention span, sustained interest, involvement with community issues and other desirable educational goals are demonstrated to be resultants of student involvement with living vertebrates studied in their "natural" state.

### *Introduction*

The "charge" to speakers during this first segment of the conference is "... to examine the basic premise of education—and the extent to which animal studies may contribute." There are, in fact numerous premises, and reference will be made later to them under the rubric, "Educational Objectives." In order to make concrete the objectives, reference will be made also to specific in- and out-of-class hands-on activities with vertebrate animals. Consequently, my presentation will overlap somewhat with the objectives set for the afternoon session, and I am assuming that this paper will, nonetheless, meet with the approval of the chairman, and that it will be acceptable to subsequent speakers.

The Institute for the Study of Animal Problems (ISAP) clearly exists to relate to animal problems. My opening position suggests that numerous animal problems derive from people problems. Some kids in my neighborhood derived evident pleasure from dashing frogs against rocks in a nearby creek. Beetles were tortured with matches. These children were perhaps sublimating aggressions against creatures whose defenseless posture enabled these events to occur. A *Saturday Evening Post* cover by Norman Rockwell comes to mind. The cover was divided into four scenes: The first quarter showed a husband being reprimanded by the boss; the second scene depicted that husband expressing anger toward his wife after he arrived home. The third part of the scenario illustrated the wife yelling at her child and the last quarter of the cover enabled the viewer to see how the child vented his frustration on the pet dog. The child was vigorously wagging his finger in the face of the dog whose expression was priceless. No animal maltreatment was depicted by Rockwell, as we would expect. The scenario, however, has remained in my mind as one example of passing the buck to a defense-